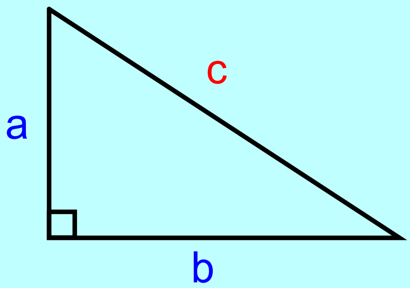
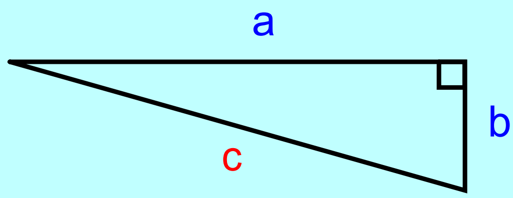
Recall: The Pythagorean theorem (see p.68 to review)

In a right-triangle, $a^2 + b^2 = c^2$, where

$c^2 = a^2 + b^2$
$a^2 + b^2 = c^2$
$a^2 = c^2 - b^2$

c is the hypotenuse
a, b are the other two sides





$b^2 = c^2 - a^2$

L3(2.2)-Length of a Line Segment

A line segment is a straight line between two points. The length of a line segment can be determined from the coordinates of the two points:

(3,7)

1. Connect the points with a line segment.

(1,4)
x_1 y_1

2. Construct a right-triangle, where the line segment is the hypotenuse.

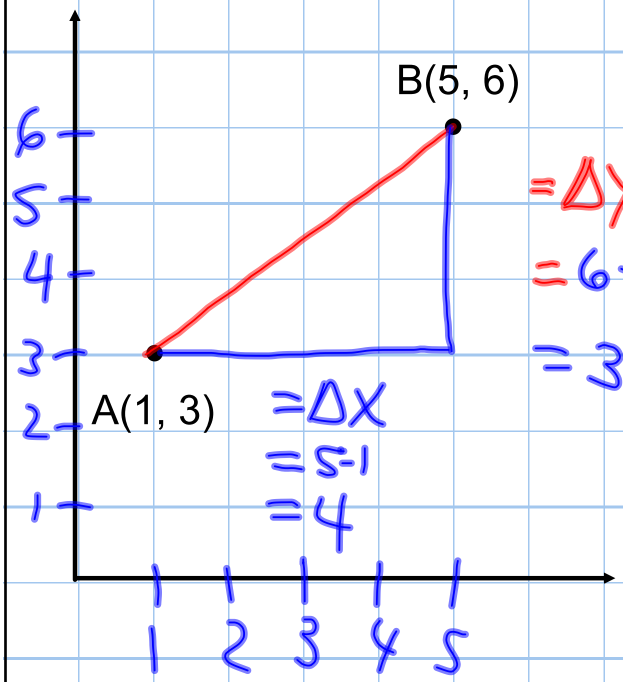
3. Use the Pythagorean theorem to find the length of the line segment (hypotenuse).

Therefore, the distance between any two points can be calculated using:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Ex.1 Determine the length of AB (d_{AB} or $\overline{AB}$)

$5^2 = \sqrt{25} = 5$

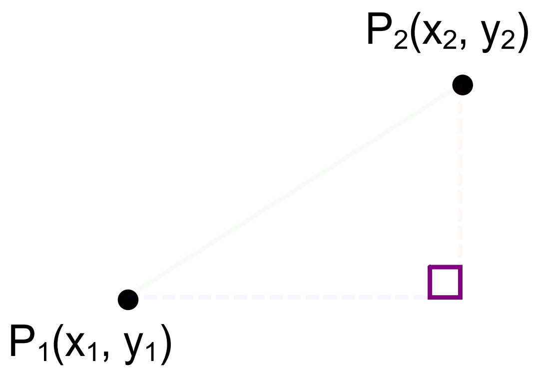


$= \Delta x$
$= 5 - 1$
$= 4$

$= \Delta y$
$= 6 - 3$
$= 3$

$c^2 = a^2 + b^2$
$= 4^2 + 3^2$
$= 16 + 9$
$\sqrt{c^2} = \sqrt{25}$
$= 5$

To derive a formula, consider two general points,
Point #1 is $P_1(x_1, y_1)$ Point #2 is $P_2(x_2, y_2)$



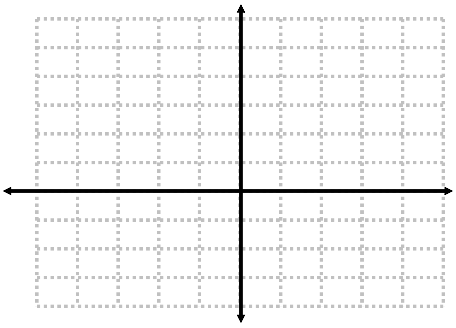
Therefore, the distance between any two points can be calculated using:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

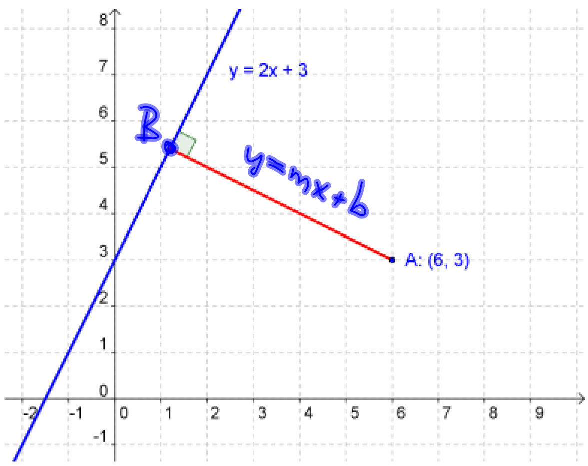
Ex.2 What is the distance between the points G(-3,1) and H(4,5)? *Give an exact and approximate answer rounded to the nearest tenth.*

$x_1\ y_1$ $x_2\ y_2$

$$d_{GH} = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$
$$= \sqrt{(4-(-3))^2+(5-(1))^2}$$
$$= \sqrt{(7)^2+(4)^2}$$
$$= \sqrt{49+16}$$
$$= \sqrt{65} \quad \underline{\text{exact}}$$
$$\doteq 8.1 \quad \text{approx}$$



To determine the distance between a point and a straight line, draw the <u>perpendicular</u> line through the point.



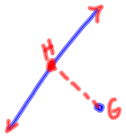
Steps:

1. Determine the equation of a perpendicular line passing through the given point. $m_\perp = \frac{-1}{2}$

2. Determine the point of intersection between the new line and the original line.

3. Calculate the distance between the original point (A) and the new point of intersection (B).

Ex.3 Calculate the distance between the point G(6,-1) and the line y = 3x + 1. *Give an <u>exact and approximate</u> answer rounded to the nearest tenth.*



$m_\perp = -\frac{1}{3}$

$y = -\frac{1}{3}x + b$

Sub (6,-1) to solve b

$-1 = -\frac{1}{3}(6) + b$

$-1 = -2 + b$

$b = 1$

① $y = -\frac{1}{3}x + 1$

$-$ ② $y = 3x + 1$

$0 = -\frac{10}{3}x + 0$

$-\frac{10}{3}x = 0$

$x = 0$

Sub x=0 into ①

$y = -\frac{1}{3}(0) + 1$

$y = 1$

$(\overset{x_1}{6}, \overset{y_1}{-1})$ & $(\overset{x_2}{0}, \overset{y_2}{1})$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(0-6)^2 + (1-(-1))^2}$

$= \sqrt{36 + 4}$

$= \sqrt{40}$ exact

$\doteq 6.3$ approx.

Assigned Work: p.86-87 # 1ac, 4cd, 6, 7(draw), 12ab, 15